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390,051

	Type	L #	Hits	Search Text	DBs	Time Stamp
1	BRS	L1	85551	malfunction or (hardware adj failure)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:21
2	BRS	L2	171451	aircraft or aerospace	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:21
3	BRS	L3	27246	display near (color or colour)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:22

	Type	L #	Hits	Search Text	DBs	Time Stamp
4	BRS	L4	438	identical adj (processors or controllers or CPUs)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:23
5	BRS	L5	123	redundancy adj management	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:23
6	BRS	L6	0	1 and 2 and 4 and 5	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:24

	Type	L #	Hits	Search Text	DBs	Time Stamp
7	BRS	L7	2	1 and 4 and 5	USPAT; US - PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:26
8	BRS	L9	0	1 and 4 and 8	USPAT; US - PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:26
9	BRS	L10	0	1 and 3 and 8	USPAT; US - PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:26

	Type	L #	Hits	Search Text	DBS	Time Stamp
10	BRS	L11	0	5 and 8	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:26
11	BRS	L8	108	345/618.cc1s.	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:31
12	BRS	L12	32151	color near (change or vary)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:32

	Type	L #	Hits	Search Text	DBs	Time Stamp
13	BRS	L13	0	1 and 12 and 8	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:32
14	BRS	L14	4	"fault-tolerant" and 12	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM TDB	2002/01/15 12:38

United States Patent [19] **Sprole, Jr. et al.**

US055812102A
[54] **VITAL MONITORING SYSTEM FOR SEVEN-SEGMENT DISPLAY USED IN RAILROAD APPLICATIONS**

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[51] **Int. Cl.°:** G06F 3/14

[52] **U.S. Cl.:** 345/34; 345/46; 345/117

[58] **Field of Search:** 345/32-54, 117, 345/207; 340/815,44

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[11] **Patent Number:** 5,812,102

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[57] **Primary Examiner—Steven J. Saras**

Assistant Examiner—Vincent E. Kovalick

Attorney, Agent, or Firm—Kevin A. Sembrat

[58] **ABSTRACT**

A system and method of monitoring light emitted from a light emitting diode (LED) display device, which typically has a plurality of selectively energizable display segments which are grouped to form desired shapes and/or alphanumeric characters, is provided, particularly for use in an Aspect Display Unit (ADU) that requires vitality when utilized in the railroad industry as a component of an Automatic Train Protection system utilized in the railroad industry. In a preferred embodiment, each particular segment of the LED display device is independently monitored by an accompanying independent dual photo-transistor circuit when a non-vital output periodically drives each segment to a known electrical state and then back to the original state. A first and a second photo-transistor is used for each segment of the LED display. Each segment and the accompanying first and second photo-transistor is surrounded by a shield which prevents light from other segments from being detected by the particular first and second photo-transistor. The first photo-transistor is directed toward the particular segment to sense light emitted therefrom and ambient light thereabout, while the second photo-transistor is directed away from the particular segment sense only ambient light thereabout that segment. The first and second photo-transistors generate electrical signals which are representative of the light detected by each of the first and second photo-transistors. The generated electrical signals drive a monitoring circuit which generates error signals representative of malfunctioning LED display segments, based on a comparison to a fixed voltage of a difference in voltages provided from the first and second photo-transistors.

20 Claims, 5 Drawing Sheets

